SIXTY YEARS TUBERCULOSIS IN WALSALL SUB-REGISTRATION DISTRICT

Being a Thesis for the Degree of M.D.

of Edinburgh University.

by

FREDERICK WM. SYDENHAM,

M.B.,C.M., (Edin.) 1893; D.S.Sc.(Vict.)

April 1899.

DESCRIPTION OF MAP OF WALSALL ILLUSTRATING THESIS.

I have considered it advisable to send the Government Survey Map (scale 25 inches to the mile). I have marked the various streets mentioned in the text in the following colours:-

Street:	Group A in Blue
Street:	Group B in Green
Table $F\frac{1}{2}$	in Black
Table F	in Crimson.

Where under the various sub-divisions of streets two have appeared, I have noted the second class by drawing lines the correct colour on each side of the street. Sub-soils of sand and gravel are coloured brick-red, sub-soils of lime-stone, yellow. The part left uncoloured where there are streets is clay. The long red lines indicate geological faults. On the side of the long green line towards the shading are the coal measures, the rest being lime-stone. This refers to the geological formation.

SIXTY YEARS TUBERCULOSIS IN THE WALSALL SUB- REGISTRATION DISTRICT.

The following considerations are based solely upon an examination of the records of the causes of death from July 1837 to December 1898, embracing a period of sixty and a half years. I have excluded all cases of Tabes Mesenterica under the age of two years, considering that such are not true Tabes, but rather cases of Gastro-enteritis, the result of improper feeding, my experience at the Out-patient Department of the Walsall & District Hospital, in private practice, and in "parish" work being, that nearly all the so-called cases of Tabes show no signs justifying such a diagnosis. It is possible that a few of them are tubercular in nature, but they certainly are not Tabes. Also in my examination of the Death Registers I found that certain medical men had a predilection for Tabes, very few cases of Gastro-enteritis coming under their notice. Such, of course, cannot be the case. From these circumstances and from published post-mortem results I thought it better to exclude

such deaths - in some cases doubtful, and certainly incorrect in most instances. As such exclusions have occurred uniformly throughout the period under consideration, they will hardly at all affect the figures when comparing one period with another.
I have proceeded in the following manner:-

In all cases the date of death, sex, age, occupation when given, address as fully as registered, and cause of death have been written out. The names have also been extracted whenever the number of the house in which the death took place has been in the register. Unfortunately, however, the records during the first thirty years were very imperfectly kept, the numbers of the houses in which the deaths took place not being given, in fact only 27.4 per cent of all the deaths throughout the whole period of 60 years were registered in numbered houses. This deficiency considerably reduced one's opportunities of having complete inferences. While upon this point, I would like to insist upon the necessity for a more thorough registration which should include the causes of death of the other members of the same family, who have died from the same cause, and the length of time of the disease, together with the place of residence where it was contracted. This information would be

of great service from the point of view of causation of disease. I have from this information made various tables as follows:-

Table A. consisting of the deaths arranged in quinquennia with age and sex distribution, the age distribution adopted being from one to twelve months, from thirteen to twenty-three months, from two to five years, and afterwards in periods of five years up to the age of 75, all over that age being classed together.

Table B., consisting of the deaths arranged in months with sex and the same age distribution, as in Table A. This table I originally arranged in quinquennia, but as the numbers were too few when arranged in such short periods, I have made another for the 60 years taken as a whole, which gives larger numbers from which more correct conclusions can be drawn.

Table C., consisting of married and single females of the ages of 16 and over, in quinquennia, with the same age distribution as in the other tables.

Table D., consisting of records of the rainfall in Walsall arranged in months and extending over a period of 20 years. Unfortunately, I could not obtain any record further back than 1875. For this information I am indebted to Mr. N. E. Best, who has

taken the rainfall for the whole of the period, and to the Borough Surveyor of Walsall who has taken it at the Walsall Sewage Farm for twelve years past.

Table E., consisting of the occupations of the cases for the whole period.

Table F, in which I have arranged the cases occurring in 23 of the oldest streets in Walsall, all of which go back for a very much longer period of time than 1841, in which year I first began to use them, as will be explained further on. This table is arranged in decinnial periods from 1841-1890, quinquennial periods giving too small numbers to be of service.

There are other smaller tables which will be explained as they occur.

The object of this paper being to elucidate as far as possible, the chief factors in the causation of tuberculosis in Walsall during the last 60 years, I will first give a brief account of the town.

It is an ancient one, lying nearly in the centre of England, in the county of Stafford; its exact position, geographically speaking, is 53.35N of latitude and 1.58W. of longitude, about 8 miles N.W. of Birmingham and 6 miles E. of Wolverhamptom. It has rapidly

grown during the last century. In May 1801 the first census showed a population of 5274 males and 5125 females, being a total of 10,399 with 1984 inhabited houses. This population had grown in 1841, the first census after the date of the commencement of the present inquiry, to 8303 males & 7753 females, a total of 16,056 persons with 3121 inhabited houses: (these figures, together with all others regarding the population of Walsall were kindly supplied to me by the Registrar-General) and in 1891 we find 27,125 males 27,706 females, a total of 54,831 persons with 10,289 inhabited houses, a population more than treble the numbers in 1841, whereas England and Wales in the same time had not quite doubled in numbers, or taking the century, the population of England and Wales has not quite trebled, while Walsall has now more than five times the numbers it had at the beginning.

The geological character of the neighbourhood shows the silurian formation with limestone rock and the coal measures as the chief rocks. The subsoil varies very considerably, but generally speaking consists chiefly of limestone, limestone clay, ironstone clay, sand and gravel, and an old alluvial deposit passing through the centre of the town, evidently being

the mouth of some river in past ages; and in excavations in its soil various horns are found. This variation in the character of the subsoil has an importance which will be mentioned when speaking of the prevalence of tuberculosis in the various portions of the town.

The height above sea-level varies from about 370 to 485 feet, a considerable variation, as it is a very hilly town. I add a map of the town, showing roughly the various subsoils, together with the limit of the geological formations and faults. The map is a tracing of the Ordnance Survey of 6 in. to the mile, but I have myself worked with the $\frac{1}{2500}$ scale. I have shewn the lines of the faults, but I cannot find that they have any connection with the death rate from tuberculosis, although when I drew them, I thought such might be possible. I obtained the exact line of the faults and formations by first photographing the Geological Survey, which is not obtainable for this district in a scale larger than 1 inch to a mile. With a lantern I threw the slide upon a screen, magnifying it the exact size, and then substituted the map for the screen, marking the faults, etc. as they occurred.

The occupations of the inhabitants are varied,

the principal industries being saddlery of all kinds, harness making, and the manufacture of leather, and everything connected with harness furniture, as bits, bridles, buckles, chains, harness, saddle trees, iron founding, malleable iron casting, stirrup making, tanning, currying, Japanning, etc., together with brush-making, electrical apparatus manufacture, bicycle making and lock-making. There is also a large firm of clothiers employing more than 1000 hands.

In 1891 there were about 450 operatives, and fifty employers in the bit trade, about 250 employees and 30 employers in stirrup making, and 300 men at work in the blast furnaces of the town.

The character of the population is industrial, the great majority belonging to the working classes. The male sex preponderated up to the census for 1881, at which numeration the female sex outnumbered the male, and has since that time steadily increased their advantages.

Examination of deaths from Tuberculosis.

Under this heading are included deaths from Phthisis, Scrofula, Tubercular Meningitis, Tubercular Peritonitis, Hip Joint Disease and Tabes Mesenterica over two years of age; but by far the greatest number are from Phthisis, not more than 5.5 per cent of all tubercular deaths being from Tabes above the age of two, including other specified tubercular diseases as, Meningitis, Peritonitis. 1.7 per cent were from Tuberculosis expressed without any special organ being mentioned, and which would probably be lungs in most cases. In the earlier records the term consumption was rather frequently used for a few years, I have included such as Phthisis.

Referring to Table A, we see a full record of the deaths from Tuberculosis, using the term , with the limitation as to Tabes, previously mentioned. The figures in the different quinquennia for each age period are too small to enable any conclusions to be based upon them, but taking the age periods of the sum of the quinquennia, we can then arrive at figures of sufficient magnitude, and extending over a sufficiently long period of time, to enable general conclusions to be drawn from them.

Taking firstly the various quinquenna for all ages and both sexes we note the variations in the death rates, and from these and from the populations estimated in the middle of each quinquennial period, we obtain the following death rate per 100 living at all ages.

	Walsall Population.	Total Deaths. Males.	Females.	Both Sexes.	Male	Female.	Rates per 1000 living at all ages. Total.	Male.	Female.
1841-45.	17343	8989	8354	266	138	128	3.06	3.07	3.06
46-50.	19917	10361	9556	225	112	113	2.26	2.16	2.36
51-55.	23506	12146	11360	255	144	111	2.16	2.37	1.95
56-60.	28112	14347	13765	278	140	138	1.97	1.95	2.00
61-65.	32244	16336	15908	335	193	142	2.07	2.36	1.78
66-70.	35902	18114	17788	297	147	150	1.62	1.62	1.63
71-75	39537	19813	19724	371	207	164	1.87	2.08	1.66
76-80	43152	21433	21719	411	242	169	1.88	2.25	1.51
81-85.	47427	23464	23963	330	175	155	1.39	1.49	1.29
86-90.	52363	25905	26458	319	176	143	1.21	1.35	1.08
91-95.	57951	28602	29349	389	231	158	1.34	1.61	1.07
96-98.	62077	30993	31014	256	154	102	1.37	1.65	1.09

and Comparing Walsall with England & Wales we find, taking both sexes, and at all ages;-

	1851-55.	56-60.	61-65.	66-70.	71-75.	76-80.	81-85.	86-90.	91-95.
Walsall	2.16	1.97	2.07	1.62	1.87	1.88	1.39	1.21	1.34
England & Wales.	2.85	2.60	2.56	2.44	2.21	2.04	1.83	1.63	1.46

that the tubercular death rate (always understood with limitations mentioned above) for the former, which is but little greater than its phthisis death rate, has

been all along a little below the phthisis death rate for England & Wales. Comparing the male and female rates, we find that whereas previously to 1870 sometimes the male and sometimes the female predominated, since that date the male rate has kept higher than the female, the difference becoming more apparent with each succeeding quinquennia. The increase of female population over the male has already been referred to as only a recent change in their respective proportions in this town.

This relative increase in the male rate exists also in the country generally, although Wilson Fox in his "Treatise on Diseases of the Lungs & Pleura", gives a report received from the late Registrar-General, Dr Ogle, in which he states that the death rates for the two sexes at all ages are practically equal, but this statement does not now apply. It was based upon the results of three decennial periods, 1850-80, in which the change was occurring, giving naturally an average rate for both sexes. An examination of the following fuller table will show the incorrectness of this statement as things are now.

		51-60.	61-70.	71-80.	81-90.	91-95.
England & Wales. All ages.	Male	2.57	2.46	2.20	1.84	1.63
	Female.	2.77	2.48	2.02	1.60	1.30

This changed death rate is, I think, in Walsall at any rate due to the improved housing of the working classes acting in a manner to be shown later.

Probable Factors in the Causation of Walsall Tuberculosis.

We will first consider street and locality infection. By this I mean the power any street or locality possesses of causing tubercle in those living in it. In a consideration of this factor in the abstract there are some general principles which must guide us. Suppose that a particular street or locality shows a greater number of phthisical deaths than another, are we to conclude that such street or locality has some factor resident within it which causes the excessive tubercle? We must always take into account the number of houses in such street; for, if one street have 30 houses and 4 deaths, and another have 20 houses and 3 deaths, the latter with the fewer deaths has the higher ratio. It is the ratio of deaths to the houses in any locality and not the total number of deaths in such locality which determines its tubercular character or otherwise. We have to also eliminate one or two factors. Firstly, deaths occurring in the same house may be due to hereditary causes, or to house infection, which is a different matter altogether to locality or street infection. By house infection is meant that a certain contagiousness

exists about a house in which a phthisical patient has lived, and that any individual going to live in such a house would run a risk of contracting phthisis. By street or locality tendency to tuberculosis, we do not mean contagious in the ordinary sense of the term, but that there are certain factors which predispose to the disease, as for example, the nature of the subsoil, height of ground, water, prevailing winds, etc. Similar periods must be compared, and not one quinquennia or decennium with another, as there may have been altogether different and additional factors brought in which may prevent the localities being comparable. If we desire to eliminate the present factor, we must not examine and compare streets of a totally different social character. One quinquennia may be compared with another, the same street or locality being taken for the purpose, but one street must not be compared with another over different periods of time, streets of diverse social character may be compared, if we bear the fact in mind when drawing conclusions as differences in death rates may be due solely to this one factor.

In comparing streets and localities with one another, I have endeavoured to compare streets of similar character. It is with a view chiefly to the kind of subsoil they possess that I have brought them forward.

To obtain sufficiently high numbers I have taken several streets of a class or of two classes and compared them with others of a similar class or classes.

Street Group A.

Streets	No. of tubercular deaths.	Streets	No. of tubercular deaths.
George Street.	36	Short Acre	67
Temple Street.	5	Long Acre	45
Dudley Street	81	Blue Lane	110
Peat Street.	17	Wisemore	76
Birmingham St.	27	Day Street.	22
Orlando Street	21	Wolverhampton St.	69
Newhall Street	17		
New Street	62	Total.	389
Ditch	26		
Upper Rushall St.	70		
Hill Street	37	Total number of yards in these streets on clay	= about 2000.
Total	399		

Total number of yards in those streets on sand = about 1988.

The 1988 yards of streets are upon a sandy and gravel subsoil; the 2000 yards are upon a subsoil of clay.

The comparison extends over a period of 60 years. These streets are in every way comparable, both in class of population, class of house, and age of streets all being very much older than 60 years; most of them being more than 100 years old, and existing for the last sixty years in pretty much the same condition.

To obtain as exact results as possible, I have only chosen streets that have remained almost unchanged, and this has of course diminished the material at my disposal, but added greatly to the accuracy of any conclusions drawn. These two groups of streets are inhabited solely by the very poor, and this fact is important as will be shown later on.

Two other groups of streets I now take, the one on sand and the other on clay, but these are of a better class and are inhabited by the upper working classes. The houses are larger, better ventilated, and many possess a small garden. As these houses are of more recent date, being about 25 to 40 years old, I have only compared them for the last 18 years.

Street Group B.

Streets on Clay.

Streets	No. of Tubercular Deaths
Victor Street	9
Spout Lane	14
Bescot Street	9
Walsingham St.	10
Richmond Street	5
Total	47

About 1293 yards.

Streets on Sand & Gravel.

Streets.	No. of Tubercular Deaths.
Chapel Street	1
Mount Street	6
Brace Street	5
Corporation St.	1
South Street	3
White Street	2
Monstrath St.	5
Newport Street	4
Oxford Street	6
Bath Street	5
Stratford St.	3
Hope Street	4
Total	45

About 2579 yards.

We see a great change in the tubercular character of the two groups of streets, those in Group B. on the sand having fewer deaths and with twice the population upon double the area than those upon the clay in the same group. Thus, ratio of population to area is the same in both classes of streets, the only difference being the nature of the subsoil.

In the first set of comparisons, Street Group A, where we had houses of a very poor character, poor sanitation, over-crowded and want of light and ventilation and cleanliness, there was practically no difference between the death rates upon the sand and clay. In Group B. however the death rate upon the sand is about half that upon the clay. In both groups of cases I took the streets out of my street list, which is a list of all the streets in Walsall with the number of cases of Tuberculosis occurring in each street arranged in quinquennia, simply picking out all upon sand and gravel, and those upon clay subsoils. I arranged them each in two lists, the one containing the very poor houses, and the other the better class houses; then picking out all those which by their age and relative unchangeability were suitable for comparative purposes, I made the four lists submitted. I did not expect the results I found, for I thought that the

gravelly and sandy soils would in both groups show a smaller number of deaths than the clayey. I was surprised to find the great advantage possessed by the sandy soils in the better class of house, and more surprised to find that it made practically no difference in the case of the insanitary class of house, inhabited by the very poor. I will now deal with the question of house infection. It is a very difficult subject, especially from the standpoint at which we have to view it here. We have to deal with a death record, and a very imperfect one too, and not with an attack rate, for an individual dying of tuberculosis in a house, may not have contracted such disease in that house, phthisis being a disease which may run a long or short course, according to circumstances, and this latter fact considerably complicates the question when viewed from the records of death. The average duration of phthisis varies considerably according to different authorities. Wilson Fox says: "The duration of Phthisis is therefore in the abstract a matter of extreme uncertainty; the disease may last in the chronic state from 20 to 40 years, or, excluding acute tuberculosis, prove fatal in from 6 weeks to 2 months or even a week." Ortel gives 10 days to 40 years.

Louis found that half died in less than 9 months, Laennec and Andral give 24 months as the mean duration. Louis and Bayle together give 23 months, Austin Flint says 33 months is its average duration, C.J.B. Williams & Sir J. Clark say 4 years. C.T. Williams gives an average drawn from 198 patients of 7 years & 8 months, but he also gives a list showing that the greatest number lived 5 to 9 years. He stated that 65% lived five years and upwards. Dr. J. E. Pollock, from 3500 cases of Phthisis attending the Out-patient Department of Brompton Hospital, says that two years, six and three-fifths months, including acute and chronic cases, was the average duration while under observation, and that the actual average duration of the disease must have been about 4 years. Dr. Percy Kidd says: "That an experience of 12 years outpatient work at the Brompton Hospital has convinced me that Dr. Pollock is far nearer the mark than those who would limit the average duration to two years. Another important point in regarding the question of house infection is the length of time during which the expectorated tubercle bacillus or its spores, if there be such, retains its power of infection. Is the period to be measured by days, weeks, or months?

Professor Ransom has shown that in Manchester

and Salford tuberculosis is most common in back to back houses, close courts, and in narrow streets. An interesting case given by Engelmann and narrated by Clifford Albutt in his System of Medicine, Vol.V., p.169, shows a clear case of house infection, but it is important to note that the house was badly lighted and ventilated, and equally as important to note the rapidity with which infection occurred. There were no long intervals before the disease was contracted, as a result of living in the infected house, excepting in the case of No.2 infection, of which Albutt says the facts pointing strongly to infection are not so convincing in this case, as some years elapsed between the tenancy of the infected house and the Deaths from tubercular disease.

In connection with the period of infection Profs: Delepine and Ransome conducted experiments, which may throw some light upon the subject. They experimented upon the power of various disinfecting agents to render inert the tubercle bacillus. A report of these experiments is given in the British Medical Journal of Feb.16th, 1895. They show to some extent the great value of sunlight in disinfecting paper infected with tubercular material. The general

conclusions at which they arrive are that fumigation by sulphurous acid, chlorine and euchlorine is practically useless, that chlorinated lime applied in solution to the walls was more satisfactory and that light is the most important natural disinfecting agent. Their experiments show that diffuse sunlight alone, without even radiant light, continued for some few days was sufficient to destroy the violence of pure cultivations of human tubercle bacillus.

Consideration of these facts along with the average duration of the disease would lead one to allow half a dozen years as a fair average period of time to elapse before we can consider that an individual, dying in a house previously attacked by tubercle, has caught the disease from house infection. We cannot imagine the tubercle bacillus retaining its infection in any average house exposed to light and air for many months, when a few days' diffuse sunlight was sufficient to prevent inoculation experiments from causing the disease. For purposes of convenience the term "attack" will be used to signify a death in any house or street, and "attack rate" to signify death rate. This question is a very different one to locality attack as in the latter there was no question of a previous attack having any bearing upon a second or third case, whereas

in house infection a previous attack is of course everything. We may ask the general question. If a house is attacked more than once, are we to infer that the second attack is one of infection? This brings us to the question of probability, which applied to our figures becomes very abstruse and of very great difficulty, the more so considering the few data with which we have to work, where the probable error is sometimes nearly as great as the figures themselves, thus rendering any conclusions based upon such, completely valueless. The question again is rendered more complex by the fact that the statistics extend over a period of 60 years. Then we have not even full information of this time, the numbered houses, as previously stated, falling short of the unnumbered. To make my remarks clearer, I will give Table F. which is an account of a number of deaths, arranged in decennia, occurring during 50 years in 23 streets of the town. I have taken these streets as representatives of one class of house, viz. those inhabited by the poorest members of the community, and I have taken all the streets which go back for a sufficiently long period and which have remained practically the same during the period over which the table extends. In

these streets we have had 1259 cases of tubercle, occurring in 1226 houses of which only 346 are numbered.

Cases, occurring in numbered houses	Street Names.	1841-50.	51-60.	61-70.	71-80.	81-90.	Houses affected twice. D = Different Name S = Same Name.
9 in	Ablewell Street	16	11	7	8	6	D. 167 ⌀
14 in	Bank Street.	16	6	8	9	8	S.S.
9 in	Birchill's St.	22	18	21	19	11	S.
22 in	Blue Lane	13	16	28	19	18	
10 in	Birmingham St.	4	5	5	4	3	
3 in	Ditch	8	3	4	2	6	
16 in	Dudley Street	18	15	14	12	8	D.124(D.166;D.17 ⌀⌀
6 in	Duncalfe St.	2	3	4	7	3	D.309.
9 in	George Street	5	7	5	10	2	
56 in	Green Lane	14	15	24	25	27	D.120, D.77 D.59, D.100 S. S. S.
8 in	Hill Street	6	6	6	8	4	D.147
14 in	Holtshill Lane	2	1	5	7	9	
6 in	Lichfield St.	7	5	10	2	6	
6 in	Long Acre	8	8	11	9	2	
13 in	New Street	16	14	7	11	6	S.
8 in	Port Street	7	9	6	3	6	
9 in	Portland St.	3	11	7	8	6	
31 in	Rushall Street	42	33	33	29	20	D.42, D.46, D.28.
8 in	Ryecroft St.	6	15	9	6	4	D.86
18 in	Shortacre	9	10	11	11	16	D.111, D.33
32 in	Stafford St.	18	32	25	22	19	S.S.S.
15 in	Wisemore	18	12	11	12	6	D.187, S.
24 in	Wolverhapmton St.	14	6	9	12	13	D.217, D.171, D.46., S.
346	Walsall Tubercle Death Rate per cent.	274 2.66	261 2.06	260 1.84	255 1.87	209 1.30	

Taking 1000 to represent the figures in the first decennium, we have

Comparative figures showing tubercular death rates & street deaths.

1000	952	948	930	762 = Street
1000	774	699	703	488 = Tubercle Death rate.

⌀ The numbers after the letter D. signify the intervening period in months between the deaths.

⌀⌀ The two D.s in brackets signify that one house was in this street attacked thrice.

This table shows that, taken as a whole, the deaths in those old streets have remained pretty constant for 50 years. At any rate they have not increased which would have occurred had there been much importance attachable to house infection,as each case occurring in a street would be a factor, varying in importance to that of house infection, causing or tending to cause another attack in such house; and the street is of course other things being equal, just as liable to another attack from without as is any other street. Consequently, the older the street, the greater would be the quinquennial or decennial deaths, unless, perchance, there is some other factor at work bringing down the death rate when - the fact that the deaths remain constant - it would be in favour of house infection. But there have been no such known factors in these streets. The known important factors in phthisis causation are heredity - which undoubtedly plays a very important role, and it may be difficult to decide in many cases how much is due to this and how much to house infection - back to back houses and dampness of house or soil,which latter has been very thoroughly investigated by Dr. Bowditch in America and Sir G.Buchanan in England and is briefly and concisely given in "Treatise on Hygiene and Public Health" by Stevenson & Murthly, Vol.I, pp.355 to 362 and the conclusions arrived at by Bowditch are given in Buck's "Hygiene and Public Health",

Vol.1. pages 577-579. A very important factor as shown by Dr. Falham's Reports is the relationship of back-to-back houses, to Pthisis mortality which is practically the result of want of light, ventilation and overcrowding.

None of the known factors which reduce Pthisis mortality have been in operation in these old streets of Walsall, and yet the number of deaths has not increased as it should have done, had house infection been an important factor. Some of the known factors which reduce Pthisis have been in operation in Walsall generally, i.e. the increased comfort in the houses larger and more airy rooms, greater space around the dwelling and better lighting and ventilation generally, and with these improvements there has been a corresponding fall in the tubercular death rate. The fall has been gradual, showing that there has been no rapid improvement in the drainage of the subsoil as has occurred elsewhere under such conditions, notably Salisbury, Banbury, and Ely amongst others, where there was much drying of the subsoil as a consequence of sewage works. And there have not been any <u>such</u> sewage operations in Walsall. Walsall is however a town that has grown rapidly during the last 60 years from a population in 1841 of 16056 to one of 54831 in 1891. It has more than trebled in num-

ber. It is essentially a working class community, whose hours of labour, rates of payment, and mode of living have greatly improved, and perhaps as much as anything, their inhabitations. In 1841 the population was chiefly housed in the streets of which Table F. is a fair sample, whereas now such streets are in the minority, as is also the class of house they represent. Such being the case we should not expect to find the death rate from tuberculosis greatly improved in the older streets, which remain much as they were; while in the town generally the rate has halved (Table F.) If house infection is an important factor one would expect that out of the 346 cases of death which occurred in numbered houses there would be a considerable amount of second attacks in the same house which could be referred to house infection. There are 60.8% that show a second attack and 39.2% show no second attack at all. I have also drawn up another table F^2. which includes 32 streets of varying character, but all of about the same age, more recent than in Table F., but all extend further back than 1870 and can be well used for purposes of quinquennial comparison beginning at that date. It will be again noticed that we do not get an increase in the number

of cases of tuberculosis as would be expected under an infection theory.

TABLE F^2.

Street Names.	71-5.	76-80.	81-5.	86-91.	91-5.
Hatherton Street.	7	2	3	7	5
Intown Row	0	3	4	0	2
John Street.	7	2	0	0	2
Littleton Street.	6	3	3	1	3
Long Street.	3	0	0	0	0
Little Street.	2	1	4	3	6
Forster Street	2	4	0	2	4
Mountrath Street.	1	2	0	2	1
Navigation Street.	3	1	2	4	8
Newport Street.	3	1	2	1	1
Orlando Street.	2	4	1	1	3
Paddock.	3	4	4	5	3
Parkbrook.	3	0	4	2	3
Peal Street.	1	1	1	1	0
Penkridge Street.	1	0	3	5	3
Bridgeman Street.	6	16	9	6	3
St. Paul Street.	1	2	0	0	1
Pleck Road.	6	2	2	3	4
Queen Street.	2	7	5	2	5
Regent Street.	1	3	3	0	3
Romley Street.	3	4	1	0	4
Sandwell Street.	1	1	3	3	8
South Street.	2	3	1	1	1
Spout Street.	2	1	5	2	3
Tantana Street.	5	1	4	2	2
Teddesley	2	7	4	2	2
Union Street.	3	0	0	2	1
Hall Lane.	1	2	0	1	0
Walhouse Street.	3	3	1	2	1
Ward Street.	2	4	4	2	2
Warwick Street.	1	1	2	2	1
Whitehouse	1	0	0	0	2
Brook Street.	2	2	0	1	0
Totals	88.	87.	75.	65.	87.

But the question of house infection approached from a collection of death records, is very complex, especially as in the present case when they extend over a long period and for the following reasons:- Firstly, we have not full information, the numbered houses being only about one quarter of the whole number attacked, or 28.2 per cent. We may infer that those unnumbered would be affected in about the same ratio as the numbered ones if the figures are large enough. Then the question of probability is a vast one when applied to the specific cause of a second attack, as for example, house infection; because a certain limit of time must be fixed before one can decide upon any case being one of house infection or infection from some other cause, as from what might be termed the average probability of a second attack. For example, there are say 400 houses amongst which are distributed 800 cases of phthisis. Under such circumstances a second attack in every house would be only just the natural course of things.

In Walsall since 1837 there have been 3938 cases of tubercular disease, most of these being phthisis, at any rate all excepting about 5 per cent. During this time the number of inhabited houses has increased from 3121 in 1841 to 10289 in 1891, and we

may perhaps allow one hundred years for the average age of a house, thus in 50 years there have been erected 7168 houses, and in a slightly longer period than this 3938 cases of tubercular disease have occurred; or if we take the total number of houses 10289, of which some of the 3121 existing at the beginning of our enquiry have been attacked by tubercular disease, there will have been about 1 case to every three houses.

Then, speaking generally, after making allowances for the average age of a house in regard to its probable attack rate of phthisis, suppose we find that it is attacked greatly in excess of the theory of probabilities, we can only conclude that there are some special conditions influencing such house, and which have nothing at all to do with house infection. Thus, before concluding that cases are due to house infection, the deaths ought not only to occur in excess of the probabilities taken in the above manner, i.e. without reference to the time intervening between such repetitions of attack, but they ought to exceed the special probabilities of the case, which take into account hereditary influences, and length of time intervening between the deaths.

The probability question then is an easy matter,

and is not to be taken as in the ordinary way when estimating the sequence of ordinary events, as when one tosses up a penny and estimates the frequency with which heads will recur, say three times in succession. It is far more complex than that. Having said this much, I will analyse the cases of second attack in Table F.

We have 32 cases of second attacks, including one which was attacked three times, in 346 numbered houses - the numbers, however, only extending over a period of 20 years, all the cases occurring previously to 1870 being unnumbered. This gives us a percentage rate of 9.24. Upon examining this 9.24 per cent of the 32 double attacks, 13 or 40.6 per cent were of the same name, and as the following table, F^1, will show, probably hereditary in character.

TABLE F[1]

The names put first were the first to die.

Bank Street	A. Davis, Male, 7 years.	Hip Joint Disease.	79 months intervened.
	" " Male 43 "	Phthisis.	
	S. Hodson, Female. 9 yrs.	Phthisis.	34 months intervened.
	Thos. " Male. 44 "	"	
Birchill's St.	A. Murray, F., 6 months.	"	3 months.
	L. " F. 4 "	"	
Green Lane.	W. T. Toon, M. 8 months.	"	11 months.
	W. " M. 40 years.	"	
	M. Doulan, F. 40 years (wife)	"	4 months.
	M. " F. 21 years	"	
	M. Lanton, F. 35 years (wife)	"	24 months.
	M. " F. 1 "	"	
Hill Street.	A. T. Bagnall, F. 14 mos.	Tubercular Meningitis.	1 month.
	J. " M. 37 yrs.	Phthisis.	
New Street.	E. Platt. F. 22 months.	Tubercular Meningitis.	2 days.
	W. " M. 2 years.	Tabes.	
Stafford Street.	F. Wright, F. 6 years.	Phthisis.	41 months.
	S. " F. 41 " (wife)	"	
	S. Holden, F. 17 years	"	17 months.
	G. " M. 20 "		
	S. Adcock, F. 60 years (wife)	"	20 months.
	A. E. " F. 21 "		
Wisemore	E. Bullers, F., 19 mos.	Tubercular Meningitis.	4 months.
	H. " F. 46 yrs. (wife)	Phthisis.	
Wolverhampton Road	E. Lloyd, F. 16 years	Phthisis.	108 months.
	J. " M. 23 "	"	

The average period between the deaths of those cases having different names and therefore likely to be strangers, is 112 months, or 9.1/3 years. The seven shortest periods between infections were - 17, 28, 33, 42, 44, 46 & 59 months respectively and these give an average of 38 months. Excluding these, the remainder give an average of 12½ years and would hardly be considered cases of house infection. This gives us about 7 cases which may be possibly due to house infection or an average of 2 per cent, and it is this 2 per cent which would require to be worked out according to the laws of probability and not the 60.8 per cent which shewed a second attack.

An examination of Table F^1. gives us 13 cases of double house infection, and nine of these appear to be parent and child. Two of them are cases of children of about the same age, and the remaining two houses show cases which seem to be brother and sister, and between one there is an interval of 9 years.

The average interval is 26 months between each pair of deaths.

The total number of cases in Walsall generally during the period 1877-1898 was 3938 of which 1172 occurred in numbered houses being 2766 as having

occurred in unnumbered houses.

The 1172 cases occurred in 1069 houses of

	Houses			cases
which	975	were attacked	once	975
	86	" "	twice	172
	7	" "	thrice	21
	1	" "	four times	4
	1069			1172

Or 29.76 per cent of the total number of cases occurred in numbered houses & 70.24 per cent in unnumbered.

Of the 86 houses attacked since, 40 or 47.67 per cent were of the same name, and 46 or 52.33 per cent were of different names. Heredity, as in these previously investigated Table F2 and which are included in these has a great deal to do with the 47.67 per cent.

Of the numbered houses

975 =	91.30	per cent	were attacked	once	
86 =	8.04	" "	" "	twice	
7 =	.65	" "	" "	thrice	
1 =	.09	" "	was "	four times	
or	8.67	" "	was "	more than once	

Of the 7 houses attacked three times, 4 were all of different names, and 3 had in each house two the same and one different

The four houses with the three attacks in each, and with the names all different shewed the following intervals in months.

1st case	2nd case	3rd case
" "	25 months after	97 months after the second.
"	23 " "	101 " " " "
"	155 " "	47 " " " "
"	18 " "	257 " " " "

The remaining 3 of the seven shewed each the two same names as follows:-

S. Emery, F.	7 yrs.	Typhoid & Phthisis	12 mos: Interval
E. " F.	11 "	"	
S. Davis, M.	57 "	"	23 months.
T. " M.	22 "	"	
A. Bould, F.	6 mos.	Tubercular meningitis	35 months.
E. " F.	7 yrs.	Tuberculosis	

and the following intervals in connection with the odd name in each house. 10 months, 1 month & 59 months.

The one attacked 4 times shewed

A. Caddel, F.	17 yrs.	Phthisis	53 months.
T. Barnes, M.	42 "	"	6 months.
R. Caddel, M.	69 "	"	
S. " F.	62	"(widow)"	21 months.

The average interval for all the cases of different names is 91.6 months or 7½ years. Excluding 19 houses since infected with different names, the intervals being under five years with an average interval of 33.4 months, we obtain an average interval for the remainder of 163.8 months or 13½ years.

This gives us 19 houses which may possibly be due to house infection, a percentage upon the total number of numbered houses of 1.77 which would remain to be dealt with by the theory of probabilities.

In all the above tables I have not chosen anything to serve any particular theory, and have had to change my mind more than once while proceeding with the statistical portion. The foregoing evidence is negative of course and any amount of negative evidence is of little value compared with positive; but the circumstances and limits of this inquiry only admit of evidence of this kind. I do not deny house infection as existing, and as an evil to be coped with, but am not inclined to consider it has been of much importance in the causation of tuberculosis, in Walsall during the period under examination.

The general conclusions I would draw from the foregoing statistics inasmuch as they relate to the decrease of tubercle and its causation in Walsall are that while the general death rate from this cause had decreased considerably, no such decrease is noticeable in the other and more insanitary parts of the town because the factors causing such decrease have not been in operation there. The decrease is due to the fact that the newer parts of the town have better houses,

with more fresh air around and in them, and more light, and that the people inhabiting them are in a better condition consequently to resist the disease. They are also better paid and themselves and their families better fed than their poorer neighbours. I infer that subsoil has very little influence upon the tubercular death rate when other conditions mentioned above, see streets in groups A & B, which are very favourable to tuberculosis, are present, but, when these conditions are removed, a sandy or gravelly subsoil is unfavourable to tuberculosis and assists materially in reducing its ravages.

I also infer that house infection for the reasons above stated is not a potent factor in the spread of tuberculosis.

N.B. The high death rate of the poor houses upon sandy soil was not due to a high ground water.

I have not been able to ascertain the height and variations in the level of the ground water in different parts of the town with sufficient exactitude to warrant its introduction as a factor either way.

Rainfall and Phthisis.

I have been unable to obtain any statistics relating to rainfall in Walsall prior to 1876, of which I give a summary in months for the whole period of 20 years.

Rainfall in Walsall from 1876 - 96.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall in inches.	48.56	39.93	40.45	39.48	49.0	55.83	58.49	60.03	53.23	65.15	57.69	51.41.
Deaths M	82	59	69	71	79	69	66	63	63	79	59	59
Deaths F	63	49	52	35	50	60	63	46	51	58	45	46
Total	145	108	121	106	129	129	129	109	114	137	104	105

This table does not show any connection between the amount of rain that has fallen in the various months and the deaths that occurred in these months for the same period of time January and October, the two months shewing the greatest mortality for the two sexes are not the months of the greatest rainfall, neither are they the months after the greatest rainfall. The same want of relationship is that for the months of least mortality. It is seen also for the sexes taken separately.

Table C.

I have arranged the married and single women in this table in an age distribution of five year periods beginning at 16 and extending to 70 after which all are classed as over 70. The analysis of this table which I append compared with an analysis of the age distribution of female married and single for the last 4 census reports gives us in what I have termed the Death ratio column a means of comparing the relative extent to which tubercle affects the two states of life in the various age periods given.

ANALYSIS OF TABLE C.

Females, Married & Single, in various Age Periods.

Census Report 1861. Years.	15 -20	20-25	25-35	35-45	45-55	55-65	65 & over	Total at. All Ages
Single.	2499	1254	675	230	81	62	57	4890.
Married.	150	1435	3760	2760	1757	837	309	11008
1871 Report								
Single.	6377	3301	1971	652	302	185	128	12916
Married.	260	2706	7181	6452	4471	2345	904	24319
1881 Report.								
Single.	4095	2193	1103	299	125	85	68	25058
Married.	112	1502	4552	3905	2620	1392	500	14583
1891 Report.								
	3945	2184	1174	380	162	73	76	21836
	104	1234	3875	3191	2116	1100	435	12055
Population M.	626	6877	19368	16308	10964	5674	2148	61965
ratio of S.	16866	8932	4923	1501	670	405	329	64700
married to single. A.	.037	.769	3.93	10.86	16.36	14.0	6.25	
Ratio of M.	20	107	320	239	121	39	11	451
death from S.	171	123	100	33	19	5	0	857
Tubercle M. to S. B.	.116	.869	3.20	7.24	6.36	7.8		
Death A.S.	37	769	393	108	163	140	6.52	The same multiplied by 1000 for convenience of comparison.
Ratio B.M	116	869	320	72	63	78		
Ratio of Married to each single death.		1.13	.814	.666	.386	.557		

The table is constituted on the following principle. That the real married death rate compared with the real single death rate will be as much greater, or as much less, than the ratio of the married to the single deaths; as the single population is greater or less than the married population; for, if the deaths in each state are equal, then the death rates will vary inversely, according to their relative populations.

To compare the relative values of these death rates we must then know the populations of each state at each age period, and the number of deaths in each state at corresponding age periods. Another way of expressing these relative values which comes to exactly the same in the end is that the death ratio of married to single will be some fraction of the ratio that the married deaths bear to the single deaths, and it will bear the same ratio to this number that the ratio of the single to the married population bears to unity. So that if we divide the death ratios of married to single by the population ratios of married to single we get the real death ratio of the married as compared with the single class.

The comparison in the 1st column of ages is from 15-20 is of no service, as my statistics commence at 16, while the population ratios commence at 15, which

makes a considerable difference just at this age in this particular relationship; but afterwards although my death statistics are not arranged exactly parallel with those of the population that is to say, I classify from 21-25, 26-35 and so on, the slight difference is at these ages inappreciable.

The other columns are very interesting and show that between the ages of 20-25 the single women have a slight advantage but that after that period the advantage lies on the other side, and between the ages of 45-55 they have a death rate of less than one half of that of their married sisters. But it appears that after the age of 65 that the single women have an exceeding small death ratio probably because all who have tubercle cannot survive to this period.

These figures also do not bear out much that has been said regarding the great influence of pregnancy upon phthisis. Wilson Fox says "The rapid increase "of phthisis in the female between the ages of twenty "and thirty-five, points however somewhat strongly to "the influence of pregnancy on the development of the "disease, and this is also supported by much statisti- "cal evidence. This evidence tends to show that "phthisis frequently originates during pregnancy, and "that when previously existing, it is aggravated by "this state."

Dr. R. E. Thompson concludes "that the susceptib-"ility of single women is rapidly diminished after "30 years of age while that of married women retains "its intensity between 25 and 40 years of age (that is, during the child bearing period)" But it is between the age of 45 and 55 that the married women are most exempt as compared with the single. We will return to this when examining table A, which I will now proceed to analyse in a similar way. The total number of deaths is 3938 of which 2145 or 54.46 per cent are males, and 45.54 per cent are females, calculated at all ages. It will be seen that the population of male to female deaths varies at different ages. The variations agree in the main with those for the country generally, as given in the Registrar General's Annual Reports from 1881 to 1890, where the deaths at all ages were greatest in the male sex. This held good for the first three years of life, and for the age period 35-45 and upwards. For the intervening periods the deaths among females exceeded those among males. As regards age, deaths from phthisis fell from the first to fifth year. After age period 5-10 they increased up to age period 25-35 and then steadily decreased.

In Walsall for sixty years deaths at all ages were greatest amongst males. The male deaths were

greatest in the first of any year, and in the first quinquennia were greater than in any one subsequent. Decennium from 6-15 was the lowest of any until past 55 years of age. The heaviest mortality occurred in the Decennial period 21-30 after which it steadily diminished excepting in the quinquennia 31-35.

The female rate had its highest mortality in the 21-30 Decennium and here also the first quinquennium showed a higher mortality than any one subsequent. After the age of 30 the death gradually decreased. Comparing the male with the female mortality, we find that in the first year of life more males died than females. This is not so for the second year; and for the quinquennia 6-10, 11-15, 16-20, the female deaths are in the majority. The quinquennium 21-25 shows a male majority, but that from 26-30 a female, and the whole decennium 21-30 showed a very slight preponderance of deaths in the male sex. After this period the deaths among the males is in excess of the female for every quinquennial period until the close of life the difference becoming more and more marked. We thus see that the male deaths are slightly in excess of the female for the period 21-30 which is the chief child bearing age, consequently one can hardly consider the high female mortality at this period due to preg-

nancy as some would have. This will be made still more apparent by a glance at the analysis of Table A, which I here append.

A G E D I S T R I B U T I O N .

Years	Under 5.	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75
							1871 Census Report									
Males.	2846	2383	2153	1881	1674	1410	1381	1108	1073	871	744	507	414	258	173	127
Females.	2847	2488	2236	1924	1625	1416	1345	1049	1012	747	692	466	362	238	159	121
							1881 Census Report.									
Males.	3384	2925	2467	2253	1967	1746	1485	1248	1169	966	808	636	524	301	206	158
Females.	3357	2976	2576	2452	2157	1777	1453	1245	1199	928	804	577	497	323	217	178
							1891 Census Report.									
Males.	4917	4609	4312	3853	3325	2863	2414	2150	1756	1459	1289	906	818	550	327	235
Females.	4920	4706	4276	4050	3426	2826	2313	2037	1736	1464	1269	929	805	588	365	296

The three decennial periods from which the population ratios were averaged.

ANALYSIS OF TABLE A.

Years		Under 5.	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	over 70	all ages.
Population ratios of 3 decennial periods.	F.	11124	10170	9088	8426	7208	6019	5111	4331	3947	3139	2765	1972	1664	1149	1836	77449
	M.	11147	9917	8932	7987	6966	6019	5280	4506	3998	3296	2841	2049	1756	1109	1226	77029
	a	.997	1.02	1.01	1.05	1.03	1.00	.967	.961	.989	.952	.973	.962	.947	1.03	1.08	1.005
Death ratios for 60 years.	F.	308	89	88	191	230	235	185	155	117	87	53	29	15	6	5	1793
	M.	323	72	68	167	254	214	224	200	198	147	113	94	41	20	10	2145
	b.	.953	1.23	1.29	1.14	.906	1.09	.825	.775	.590	.591	.469	.308	.365	.300	.500	.834
a & b.	M.	.997	1.02	1.01	1.05	1.03	1.00	.967	.961	.989	.952	.973	.962	.947	1.03	1.08	1.005
	F.	.953	1.23	1.29	1.14	.906	1.09	.825	.775	.590	.591	.469	.308	.365	.300	.500	.834
The same multiplied by 1000 for convenience of comparison.	M.	997	102	101	105	1030	100	967	961	989	952	973	962	947	103	108	1005
	F.	953	123	129	114	906	109	825	775	590	591	469	308	365	30	50	834
Ratio of Male to Female deaths.		1.02	.820	.782	.921	1.136	.917	1.172	1.240	1.676	1.610	2.072	3.123	2.594	3.433	2.160	1.205

This table of ratios shews us what has been the average proportion of male to female deaths, taking into account the variations in their respective numbers, over a period of sixty years.

The population ratios have only been taken, as will be noted, over a period of 30 years. As the Registrar General adopted the present method in dividing the age quinquennia in 1871, the three censuses previously the age periods extending up to 10, to 15, and so on, but now extending from 5 to 10, from 10 to 15, from 15 to 20, &c. Still such slight change makes practically no difference in this connection.

The table shews us that, from the age of 20 years and onwards with the single exception of the period from 25-30, the male deaths exceed the female, the excess continuing to increase almost to the end of life, and that at no time after 50 are they less than those of the other sex.

It also shews that the high female death rate from Phthisis at about the period of child bearing only exceeds the rate in the opposite sex in one quinquennium, i.e., that between 25 and 30, and then only by the ratio of 1.091, and if we now turn to the married and single female ratio, we shall see that this excess is not among the married females at

all, but among the single. There is certainly no evidence that in Walsall at any rate pregnancy and phthisis have any relation of cause and effect.

The table shews that between the ages of 40-50 the male deaths ratio, exceeds the female by one and a half times, that from 50 to 55 it is twice as great, that in the period between 55 and 60 it is three times as fatal to the male as to the female, that from 60-65 it is 2½ times, and from 65 to 70 nearly 3½ times as fatal to the sterner sex.

I consider that the general improvement shewn in the female death rate is due to improved housing, for as females live more constantly at home than males, ill-ventilated, damp and badly lighted houses would affect their general health more than males, who are away from home and under better conditions usually, excepting where the houses are of the better class, as for example in group B. Of course I am referring to small houses and not to large.

OCCUPATION AND TUBERCULOSIS.

I have classified according to the Register of deaths all the cases of tuberculosis from 1837 to the present time under their respective occupations. But I find that on comparing them with the Registrar General's census reports for /61 /81 /91. In Walsall when the occupations of the inhabitants is given, that in most cases they are either altogether incomparable, or that the numbers are so few that no reliance can be placed upon them. The former condition unfortunately applied to many of the staple trades and their adjuncts, in this town due to differences of nomenclature. However, I have been able to compare a few, the table of which I add. This seems to shew on those given the highest mortality amongst, file makers, japanners, platers, clerks and brush makers. The first and last are dusty, and irritating to the lungs and bronchial tubes. Clerks are confined very much to rooms that are frequently hot and badly ventilated, and platers are subject to breathing acid and irritating fumes as a result of their particular occupation.

Some occupations gleaned from the census reports of

1861, 1881, 1891.

Occupation	Persons Occupied. 1861	1881	1891.	Deaths 1861	1881	1891	Rate per 1000 of Occupation.
Japanners.	21	20	35	1	1	2	51.58
Platers.	248	428	-	8	14	-	32.45
File Makers.	56	34	32	2	1	1	32.11
Brushmakers.	137	208	200	7	9	0	31.45
Clerks	79	314	476	5	6	4	30.26
Brassworkers.	218	422	534	5	9	7	21.14
Chairmakers.	229	352	257	5	7	6	21.08
Locksmiths.	249	441	540	9	6	5	19.79
Curriers.	143	360	616	2	4	6	11.62
Blacksmiths.	264	195	370	1	5	2	11.60
Saddlers & Harness Tool Makers.	550	2490	3878	7	19	19	8.23
Boot Makers.	268	256	236	2	1	0	3.78

I add a Map of Wallsall which serves for the purpose of shewing the subsoil of the various localities mentioned and the position of the streets referred to in the text. It is correct, being an exact copy of the 6 inches to the mile scale Government Survey. I have not marked the heights above sea level as their variations prove to have no bearing on the subject. Neither have I marked the geological formations, excepting where the limestone comes to the surface, for the same reasons. I have shaded the subsoil shewing sand and gravel, clay, limestone with limestone clay on the top. I have not thought it necessary to distinguish between the different kinds of clay which vary exceedingly in this neighbourhood.

The streets in group H are coloured
" " " " B " "

The height of the ground water and its variations of level I could not ascertain for most of the different parts of the town and therefore have not referred to it. It, however, is low generally throughout the town. Prevailing winds I could not ascertain, as no records have been kept, neither have I been able to ascertain any seasonal variations in temperature, there being no record kept.

TABLE A.

Females,

In Ages and Quinquennia.

Years.	37-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-98	Total.
1-12	22	9	6	17	16	12	6	8	14	9	6	8	10	145
13-23	5	8	1	2	1	3	2	6	11	3	6	11	9	68
2-5	7	8	4	5	13	8	6	10	8	9	6	6	5	95
6-10	7	12	8	4	5	8	5	5	5	11	4	10	5	89
11-15	5	5	6	7	9	5	10	12	7	9	2	9	2	88
16-20	9	11	11	11	5	15	20	22	18	17	25	19	8	191
21-25	15	19	11	18	22	15	15	24	22	17	22	18	12	230
26-30	11	12	24	15	17	24	26	17	19	25	16	16	13	235
31-35	9	11	10	9	17	16	15	23	16	12	16	15	16	185
36-40	9	10	13	8	10	11	13	11	13	12	18	21	6	155
41-45	6	12	6	5	9	9	16	9	13	13	7	7	5	117
46-50	2	2	8	2	6	8	9	10	9	12	6	11	2	87
51-55	7	4	3	4	2	6	5	4	4	2	6	3	3	53
56-60	2	4	1	1	4	0	1	2	4	2	3	2	3	29
61-65	1	1	1	2	1	1	1	1	3	0	0	1	2	15
66-70	3	0	0	1	0	1	0	0	0	0	0	0	1	6
71	0	0	0	0	1	0	0	0	3	0	0	1	0	5
All Ages.	120	128	113	111	138	142	150	164	169	155	143	158	102	= 1793.

TABLE A.

Males.

In Ages and Quinquennia.

Years.	37-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-98	Males.	Females	Total.
1-12	17	12	8	16	18	14	8	7	22	11	10	14	9	166	145	311
13-23	2	2	3	3	1	1	3	4	11	3	3	7	3	46	68	114
2-5	4	10	5	7	9	15	10	7	12	8	8	12	4	111	95	206
6-10	1	7	4	3	4	10	3	5	9	12	2	4	8	72	89	161
11-15	3	2	2	9	5	5	5	7	6	7	6	7	4	68	88	156
16-20	9	14	12	10	17	18	6	18	19	8	8	17	11	167	191	358
21-25	4	27	17	13	8	28	29	28	22	12	27	24	15	254	230	484
26-30	12	11	7	18	18	12	22	21	21	14	20	21	17	214	235	449
31-35	10	9	9	16	16	18	12	28	22	23	16	27	18	224	185	409
35-40	8	5	13	10	9	24	15	11	24	14	27	29	11	200	155	355
41-45	7	17	9	13	12	13	8	19	25	21	13	22	19	198	117	315
46-50	3	9	8	12	4	12	11	19	16	15	13	16	9	147	87	234
51-55	1	5	7	5	9	9	3	15	14	11	10	14	10	113	53	166
56-60	1	5	1	7	9	5	9	10	12	9	9	6	11	94	29	123
61-65	1	2	2	1	0	4	3	4	5	4	2	10	3	41	15	56
66-70	3	1	2	0	0	2	0	3	2	3	2	1	1	20	6	26
71	0	0	3	1	1	3	0	1	0	0	0	0	1	10	5	15
All Ages. M.	86	138	112	144	140	193	147	207	242	175	176	231	154	2145		
All Ages. F.	120	128	113	111	138	145	150	164	169	155	143	158	102		1793	
Total.	206	266	225	255	278	335	297	371	411	330	319	389	256			3938.

TABLE B.

DEATHS IN MONTHS, ARRANGED IN SEXES AND AGES.

Ages	Jan.		Feb.		Mar.		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total	Total	Both sexes.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
1-12	11	13	9	12	9	11	18	11	16	19	13	13	13	19	18	9	27	10	7	16	11	5	14	7	166	145	311
13-23	2	4	3	6	3	7	3	3	5	4	5	6	8	5	5	4	3	8	7	8	1	6	1	7	46	68	114
2-5	8	6	13	5	9	13	11	13	11	10	10	8	9	7	10	8	9	8	5	4	9	6	7	7	111	95	206
6-10	9	8	7	4	5	8	3	10	14	10	8	14	5	10	4	4	4	1	4	7	2	3	7	10	72	89	161
11-15	3	6	4	15	3	6	9	9	9	7	15	7	7	6	5	8	2	3	3	7	4	11	4	3	88	88	156
16-20	12	10	12	15	15	15	20	12	14	20	15	22	9	24	20	13	12	13	15	18	10	14	13	15	167	191	358
21-25	26	17	17	22	35	22	25	18	26	23	17	17	17	23	22	22	15	22	21	15	15	14	18	15	254	230	484
26-30	23	24	18	20	19	28	22	22	15	20	18	19	18	18	10	14	10	22	18	18	19	10	25	20	214	235	449
31-35	29	19	17	12	23	16	14	13	20	17	20	19	13	17	22	14	13	19	11	18	24	13	18	8	224	185	409
36-40	19	21	15	11	19	11	19	5	17	14	18	15	14	15	15	13	15	7	14	13	12	15	23	15	200	155	355
41-45	21	7	16	9	21	11	22	14	16	16	21	10	11	7	13	11	14	7	10	11	18	6	15	8	198	117	315
46-50	16	12	8	10	16	10	13	7	12	5	13	4	7	8	12	7	9	7	16	5	17	5	8	7	147	87	234
51-55	13	6	8	3	4	7	12	8	12	7	14	0	6	1	8	4	10	6	12	0	7	6	7	5	113	53	166
56-60	10	6	12	3	1	4	7	0	9	3	15	4	4	3	9	0	5	2	12	2	7	0	3	2	94	29	123
61-65	9	2	5	1	4	3	1	0	1	3	3	0	4	2	2	0	4	0	2	0	5	0	1	4	41	15	56
66-70	1	1	1	0	2	0	3	0	2	1	0	1	5	0	0	1	1	0	3	0	1	1	1	1	20	6	26
71	2	1	1	0	0	1	0	1	0	0	0	1	1	0	2	1	0	0	2	0	2	0	0	0	10	5	15
All Ages.	214	163	166	148	188	173	202	146	199	179	205	160	151	165	177	133	153	135	162	142	163	115	165	134	2145	1793	3938
	377		314		361		348		378		365		316		310		288		304		278		299		3938		

TABLE C.

MARRIED FEMALES.

In Quinquennia & Ages.

Years.	37-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-98	Total.
16-20	0	1	1	2	1	1	4	4	2	1	1	2	0	20
21-25	9	9	5	8	13	9	6	12	10	10	7	7	2	107
26-30	9	9	13	9	14	21	18	11	14	23	14	15	10	180
31-35	7	9	7	7	11	13	10	18	13	10	13	11	11	140
36-40	9	9	11	6	10	10	11	5	13	9	17	20	5	135
41-45	5	9	6	5	9	8	15	7	12	13	5	7	3	104
46-50	2	1	7	2	5	8	8	8	5	11	6	10	2	75
51-55	5	3	3	3	2	6	5	4	3	1	6	3	2	46
56-60	0	4	1	1	4	0	1	2	4	2	3	1	3	26
61-65	1	1	1	2	0	1	1	1	2	0	0	1	2	13
66-70	3	0	0	1	0	1	0	0	0	0	0	0	1	6
71	0	0	0	0	1	0	0	0	3	0	0	1	0	5
All Ages.	50	55	55	46	70	78	79	72	81	80	72	78	41	= 857.

TABLE C.

SINGLE FEMALES.

In Quinquennia & Ages.

Years.	37-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-98	Single	Married.	Both.
16-20	9	10	10	9	4	14	16	18	16	16	24	17	8	171	20	191
21-25	6	10	6	10	9	6	9	12	12	7	15	11	10	123	107	230
26-30	2	3	11	6	3	3	8	6	5	2	2	1	3	55	180	235
31-35	2	2	1	4	6	3	5	5	3	2	3	4	4	45	140	185
36-40	0	1	2	2	0	1	2	6	0	3	1	1	1	20	135	155
41-45	1	3	0	0	0	1	1	2	1	0	2	0	2	13	104	117
46-50	0	1	1	0	1	0	1	2	4	1	0	1	0	12	75	87
51-55	2	1	0	1	0	0	0	0	1	1	0	0	1	7	46	53
56-60	2	0	0	0	0	0	0	0	0	0	0	1	0	3	26	29
61-65	0	0	0	0	1	0	0	0	1	0	0	0	0	2	13	15
66-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
All Ages: S.	24	31	31	32	24	28	42	51	43	32	47	36	30	= 451		1308.
M.	50	55	55	46	70	78	79	72	81	80	72	78	41	=	857	
Total.	74	86	86	78	94	106	121	123	124	112	119	114	71	=		1308.

TUBERCULOSIS IN RELATION TO MEAT AND MILK.

A great deal of attention having been lately directed to the question of tubercle in cattle, and the dangers to man consequent, I have examined 24 cowsheds, from which milk is sold, in the neighbourhood of Walsall and which have accomodation for 303 cows. I measured them all so as to estimate their cubic capacity and noted the number and character of the cows in each, but, not having had any experience in tuberculosis in cattle, cannot say anything regarding this point. I noted the amount and character of the ventilation, and the amount of light which was present when the doors were closed. Notice was also taken of the drainage and surroundings generally.

Of the 24 sheds 7 were well lighted and ventilated, 7 were middling and 10 were badly lighted and ventilated, some so poorly lighted that one could not see the time by one's watch. This with the doors closed, which is the usual condition of things when the cows are in. The cubic capacity per cow varied considerably from about 238 cubic feet to

about 1150. I measured the depth and breadth exactly, but not the height to the top of the roof, allowing roughly for a slanting one. The average cubic capacity per cow was 490 cubic feet, the respective sheds giving per cow:-

497 c/	472 c/	416 cub. feet.
528 "	466 "	577 " "
402 "	400 "	470 " "
441 "	504 "	352 " "
428 "	238 "	472 " "
394 "	373 "	472 " "
420 "	800 "	1150 " "
465 "	390 "	really a private &
555 "	588 "	not a public shed.
330 "	760 "	
400 "	441 "	
383 "	936 "	
435 "	830 "	
252 "	600 "	

The majority of these figures are far below what they ought to be.

The conditions around the byres were in many instances far from what they should be. In two cases the sheds were arranged in a square formation with a large manure heap in the centre, four or five yards from the doors. In some the drainage was far from satisfactory. I intended making a systematic examination of the milk, but have been unable at present to find time. The report of the Royal Commission on Administrative Procedures for controlling danger to man through the use as food of the meat and milk

of tuberculous animals shows the great extent to which cattle are affected by this scourge. The percentage amongst cows slaughtered at Leipzig in 1895 was 43.51 a very serious percentage. 77% of cows in a dairy in Cheshire reacted to tuberculin, and of 6 other herds in the neighbourhood 63% were affected. (Roy. Com. Report). "Tuberculosis is almost unknown amongst those cows which are kept chiefly in the open air." (Roy. Com. Rep.). A great deal has been said concerning the value of the tuberculin test as an agent, for exterminating tubercle in cattle. In fact it is spoken of as almost the only means for this purpose.

"Prof. Delepine advocates the sweeping policy of clearing out tuberculosis by the application of the tuberculin test generally, accompanied in the initial stage by imperial compensation for the animals destroyed. Possibly this is the better policy to pursue as it is assuredly the most radical. For a time at all events, I should prefer to go more gradually to work." Paper on "Tuberculous meat & Milk" by Dr. James Niven, given before Sanitary Institute Congress at Birmingham.

The use of tuberculin and the subsequent slaughter of affected animals will not of itself remove tuberculosis from our cattle. A more im-

portant and really radical procees, and an infinitely better one, is to, at the same time, prevent the disease by removing and rendering impossible the conditions causing it, rather than to make the elimination of those affected with it our chief concern. Whatever may be the truth regarding house infection there is no doubt about the fact of byre-infection, and it is here that we must commence, if we wish to exterminate the disease. What can we expect but tubercle in our cows, when, in five, six or seven months out of the year, they are kept in confinement in sheds with the accompanying conditions I have spoken of as existing in Walsall? The herdsmen tell me that the cows are never moved from their places from the time they are penned up for the winter until when they are allowed out in the summer. Nothing else can be expected under such conditions. When I stated that 10 of the 24 sheds were badly lighted and ventilated, I meant that darkness prevailed and that ventilation was to all intents and purposes absent excepting when the doors were opened. When erected, sufficient ventilation was not allowed for, and the few openings that do exist are generally filled with sacking or wood nailed over, or anything to prevent the ingress and

egress of air. It is by improving the conditions of life amongst the cattle that we shall get a diminution in Phthisis, as we have already done in the human species. Tuberculin is an excellent diagnostic agent, but it is not preventative, and if we are to slaughter all our tuberculous cattle without paying sufficient attention to the removal of the cause, the number of cattle in the country will shortly diminish considerably.

With reference to light and ventilation, some standard light test should be adopted, such would be a very easy matter. Certain sized letters printed upon paper of a certain tint should be distinguished at a fixed distance, and would be quite sufficient for all practical purposes, and a fixed minimum could easily be adopted. A Minimus of ventilation area per cow should be enforced, varying according to the cubic area per cow, for which a minimum of 800% is highly desirable. That such conditions can exist and pay at the same time is shown by one or two of the sheds mentioned above, that have them, and that exist not for pleasure but for profit.

A minimum floor space should be insisted upon. The floors of many of the sheds were in a very bad

state, as also were the walls. The animals ought to have separate troughs also, a point which is hardly ever attended to here. Not in one instance was there a really proper trough. This of course important from the point of view of infection. I do not suppose that the sheds around this neighbourhood are any worse than the average for the county generally. The same faults would be found, the same objections raised, to most of the cowsheds anywhere. Sufficient, howevere, is now known of tubercular infection to give weight and authority to such objections, and every local sanitary authority should frame and enforce bye-laws upon this matter, and, that there be some sort of uniformity about them, they should be all framed upon a common model. Not only should local authorities have power with reference to their own cowsheds, but also over all sheds and dairies from which milk comes, and is sold in any locality under their jurisdiction.

(Signed) Fredck. Sydenham.
M. B. Edin; D. S. Sc. Vict.